

Root and Vegetable Storage

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Vegetables can be stored for extended periods of time with proper temperature and moisture control. A simple, properly-managed storage room or cellar will provide temporary storage for much of the produce the home gardener raises.

Storage Areas

A root cellar, mostly below ground, is excellent for storing vegetables requiring cool, moist conditions. Cellars can be dug into a bank or on level ground and covered with soil and an insulating material like grain straw to provide cool but non-freezing storage at minimum cost.

Cooling in the fall is provided by opening ventilators or doors at night and closing them during the day. During the winter, little if any ventilation will be required to maintain the temperature at the desired level. In severe climates, some heat may be needed to prevent freezing. Properly built, the root cellar may also serve as a storm cellar in tornado areas. Root cellars are often left with earth floors which can be moistened if necessary to provide the proper humidity for good storage.

Modern basements are usually too warm and dry for proper storage. A suitable storage room can be made, however, by partitioning-off a room within the basement area. The room should be built on the north or east side of the basement if possible and in an area without heating ducts or hot water pipes. The walls and ceiling should be adequately insulated. Ventilation can be provided through a basement window. Common practice is to extend a flue from half the window almost to the floor. The other half of the window is covered and insulated. As with the earthen root cellar, ventilators are opened at night and on cool days to maintain desired temperature. Ventilator openings should be covered with a wire screen to keep out small rodents and insects. Humidity can be controlled by sprinkling water on the floor if stored produce appears to be wilting. A slatted floor and slatted shelves will provide good drainage and air circulation around stored produce.

Temporary storage of root crops can also be provided in pits, trenches, or mounds if a root cellar or basement storage is not available. Storages of this type are described by Horn and Wilson

in *Storing Fresh Fruit and Vegetables*, 1977 Yearbook of Agriculture-Gardening for Food and Fun. Another good reference is *Storing Vegetables and Fruits in Basements, Cellars, Outbuildings and Pits*, USDA Home and Garden Bulletin No. 119.

Temperature

Temperature is the most important factor in maintaining quality of stored produce. Many vegetables and root crops store best at temperatures between 32° and 40°F (0° to 5°C). A manually-operated ventilation system using cool outside air to cool the storage during the late fall and winter months works well in areas where outside temperatures are freezing or below. Such a system is inexpensive to build and operate but may not be satisfactory in warmer climates or warmer periods of the year. Mechanical cooling may be preferred in warmer areas even though it is more expensive to install and operate. The accompanying sketch illustrates several low-cost methods of providing both natural and mechanical cooling for basement area storages.

Natural Cooling

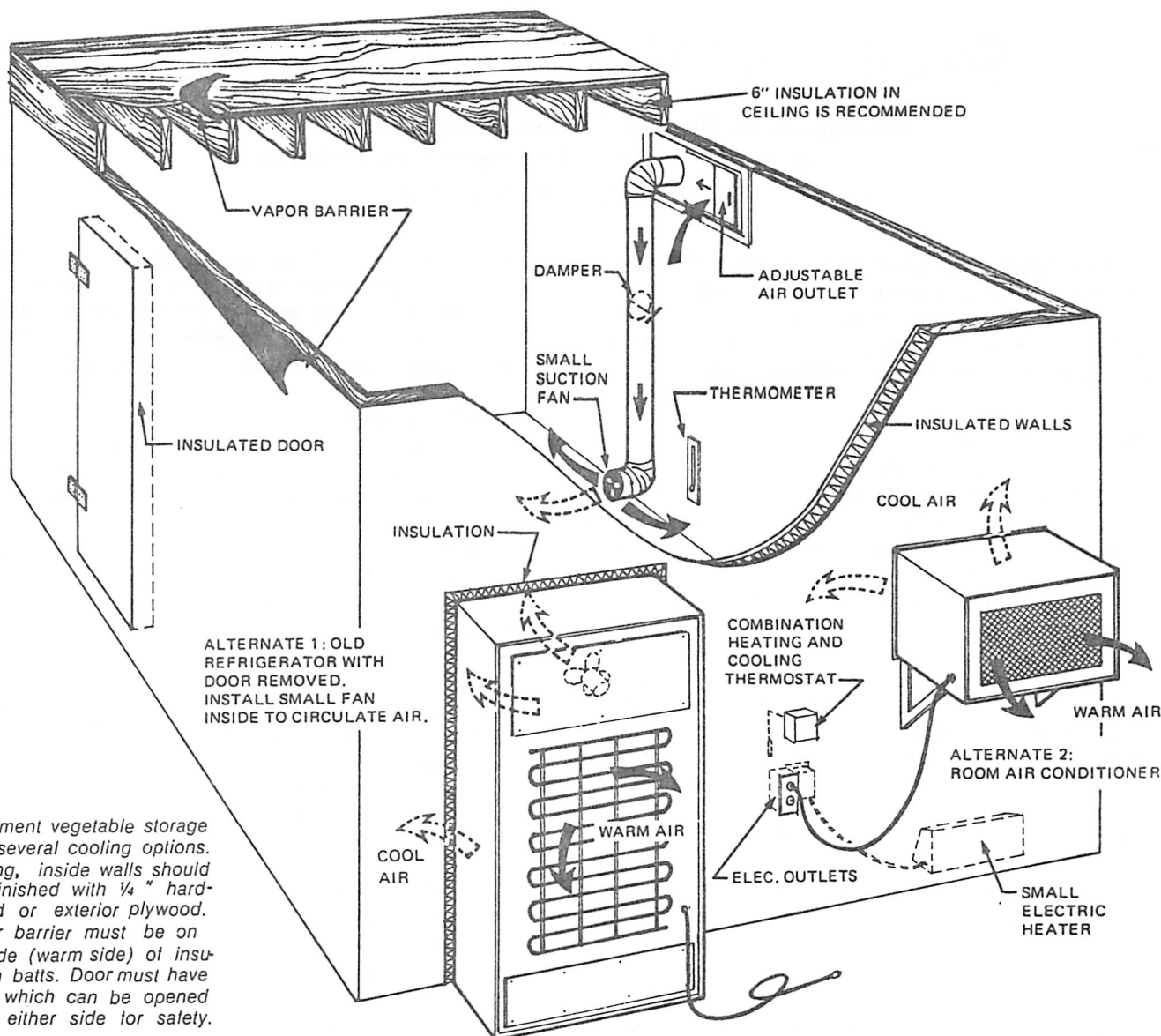
A manually-controlled ventilation system can be built into any storage with access to outside air. Ductwork and sliding vents will be needed to control air flow. This system requires considerable attention for checking temperatures and adjusting vents to maintain desired temperature.

A small, thermostatically-controlled fan in the vent duct would help control storage temperatures through a wider range of outside temperatures. A differential thermostat may be used to operate the fan whenever outside temperature is lower than storage temperature down to a desired minimum, say 35°F (2°C).

It is desirable with any manually-operated ventilation system to have a small electric heater with a low-temperature thermostat to avoid possible freezing in the storage room. This unit protects stored produce in case of sudden weather changes or failure to make correct ventilator adjustments.

Mechanical Cooling

Mechanical cooling costs more than natural cooling but provides the most positive method of



Basement vegetable storage with several cooling options. Ceiling, inside walls should be finished with $\frac{1}{4}$ " hard-board or exterior plywood. Vapor barrier must be on outside (warm side) of insulation batts. Door must have latch which can be opened from either side for safety.

temperature control with little attention. Mechanical refrigeration should be considered if there is a probability that minimum outside temperatures will be higher than 40°F (5°C) during much of the storage period. Even a week of high temperature in the storage room may considerably lower the quality and storage life of produce.

The basement storage sketch shows how an old refrigerator with the door removed can be added to the storage room to provide cooling. Condenser coils should be outside the storage area since they give off heat. A small fan inside the refrigerator will aid air circulation and prevent icing on the cooling coils. A window air conditioner removed from service in the fall can be used to provide cooling until outside temperatures are low enough to cool the storage properly. A reliable thermometer is essential for proper operation of any home storage room.

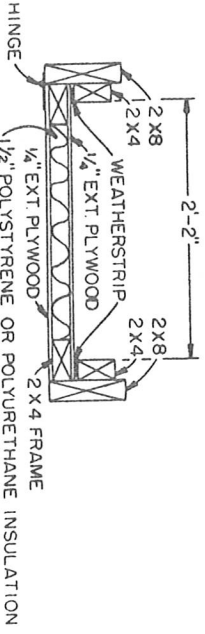
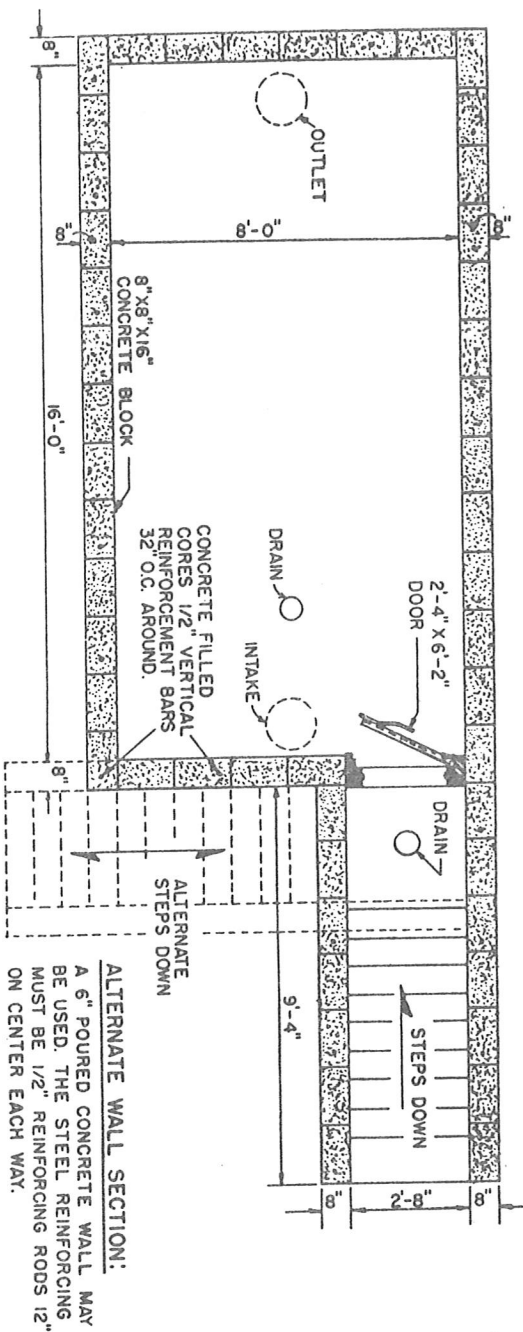
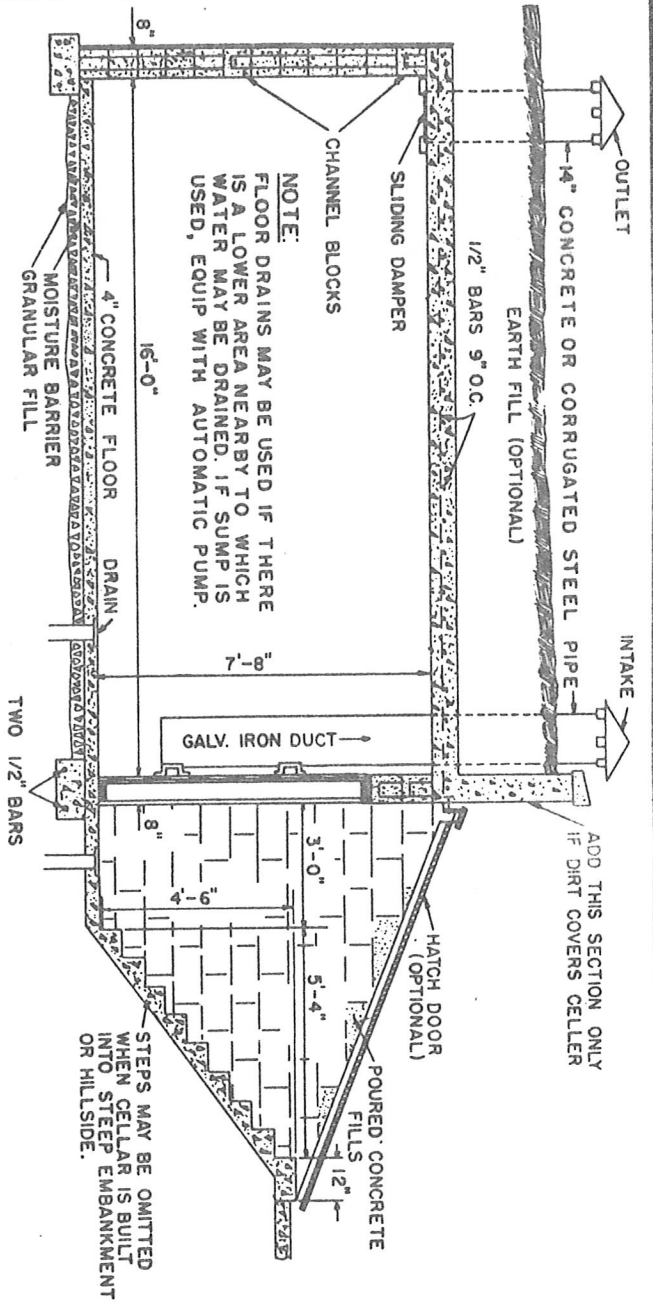
Humidity

Humidity control is important in a storage room. If the humidity is too low, fruits and vegetables may lose water, causing shriveling and lower quality. Humidity as high as 90-95% is desirable for most

root crops. Sprinkling water on the floor, covering the floor with damp straw or sawdust, or placing large pans of water on the floor or under ventilators are simple ways of increasing humidity in the storage area. Packing root crops in dry sawdust may require no additional humidity since sawdust tends to remain moist below the surface and does not draw moisture from the produce. Sawdust used in this manner will also insulate produce from sudden temperature changes. Storing vegetables in perforated polyethylene (plastic) bags will also help reduce moisture loss and control odor migration from one product to another.

Pre-Storage Preparation

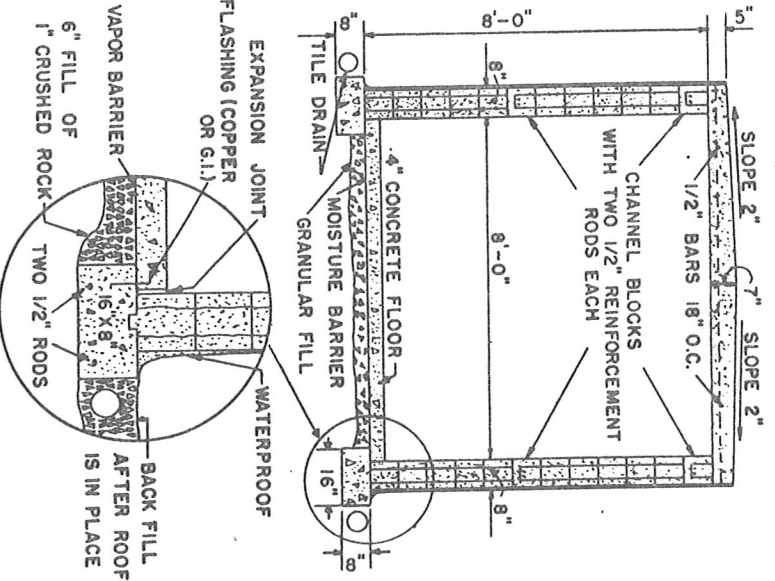
Harvesting should be delayed as long as possible without danger of freezing. Most root crops can withstand some freezing without damage, but alternate freezing and thawing should be avoided. Try to harvest root crops during dry, summery weather—not too soon after a rain. Allow freshly-harvested root crops to remain on the ground several hours or overnight to dissipate "field heat" before placing in storage. Onions should dry outdoors for about a week before storing. When pre-



DOOR DETAIL

WATERPROOFING:
WATERPROOFING MAY BE DESIRABLE IN AREAS OF HEAVY RAINFALL OR HIGH WATER TABLES. WATERPROOF BY APPLYING 1/2" PORTLAND CEMENT PLASTER (USING 1 PART CEMENT AND 3 PARTS SAND) TO OUTSIDE WALL. ALSO USE 2 COATS OF BITUMINOUS MATERIAL IF NEEDED.

CONSULT LOCAL HEALTH AND BUILDING CODE AUTHORITIES BEFORE STARTING CONSTRUCTION.



VENTILATOR DETAIL

paring any vegetable for storage, leave an inch or so of tops or stems to prevent "bleeding" and scars in which decay can start or nutrients lost.

Storage Conditions

Most root crops need cool, moist storage conditions. Other produce, like pumpkins and squash, need warm, dry storage. Still others, like onions, need cool, dry conditions. The accompanying chart provides storage condition guidelines for various fruits and vegetables. Heat rises, so produce requiring higher temperatures should be stored on upper shelves. Pumpkins and squash store best in single layers on shelves but should not touch each other.

Cleanliness is essential for effective storage. Keep the storage room free from decaying fruit or vegetables to prevent bacteria from spreading to sound produce. Thoroughly clean and wash the storage room and all storage containers with detergent and disinfectant after each storage season. Applying two coats of moisture-proof paint to the interior of the storage room will improve its looks and aid sanitation. As a further precaution, spray the storage room and containers with an approved fungicide for disease control.

Handle vegetables carefully to prevent bruises and cuts which will shorten their storage life. Store

only produce of good quality. Diseased or damaged produce will spoil and quickly damage all other produce touching it. The old saying, "One rotten apple will spoil a barrel full," is very true.

This fact sheet based on material originally prepared and approved by University of Wyoming Agricultural Extension Service for publication by WRAES.

Available Plans

- W1012 (1 sheet)—Root and Vegetable Storage, 5 x 10 ft concrete block with steps, air intake and outlet vents.
- 6228 (1 sheet)—Fruit and Vegetable Storage Room, 10 x 10 ft insulated corner room in basement.
- 5948 (2 sheets)—Storage and Fallout Shelter, 10 x 14 ft cast concrete shelter with steps, entrance passage.
- 5866 (1 sheet)—Storm and Storage Shelter, 8 x 10 ft cast concrete with steps, filling chute, gravity ventilator.
- 5748 (1 sheet)—Root Celler, 8 x 10 ft post, beam and timber shelter with filling chute, step entrance, ventilator.
- 5591 (1 sheet)—Fruit and Vegetable Storage, 16 x 28 ft above-ground concrete block with natural ventilation.
- 5492 (1 sheet)—Root Storage House, 12 x 16 ft insulated wood wall above-ground with natural ventilation.
- 5176 (1 sheet)—Vegetable Cellar, 8 x 12 ft cast concrete with flat or arched below-ground roof, stairs, air outlet.

Order above plans at \$1.00 per sheet from WRAES, Gilmore 116, Oregon State University, Corvallis, OR 97331. Be sure to include your name, mailing address and check or money order payable to "WRAES."

Storage Conditions for Selected Vegetables and Root Crops

Crop	Temperature (°F)	Humidity	Curing	Storage period
Beans & peas, dry	32-40	Dry	3-4 days at 0°F or 15 minutes at 180°F	Years
Beets	32-40	Moist	None	3-6 months
Cabbage	32-35	Moderately moist	None	3-4 months
Carrots	32-35	Moist	None	3-6 months
Cauliflower	32-35	Moderately moist	None	6-8 weeks
Celery	32-40	Moist	None	1-2 months
Onions	32-35	Dry	Dry thoroughly	6 months
Parsnips	32-40	Moist	None	6 months
Peppers	45-50	Moderately moist	None	2-3 weeks
Potatoes, early	45-55	Moderately moist	1-2 weeks at 60-75°F	6 weeks
Potatoes, late	35-45	Moderately moist	1-2 weeks at 60-65°F	6-8 months
Potatoes, sweet	55-60	Moderately dry	10 days at 80-85°F	6-8 months
Pumpkins & squash	55-60	Moderately dry	10 days at 80-85°F	3-6 months
Tomatoes	55-70	Moderately dry	None	1-3 months
Turnips	32-40	Moist	None	6 months